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TRANSMITTAL FORM

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First Named Inventor	Zhan, Guodong
Art Unit	3743
Examiner Name	Duong, Tho V.
Attorney Docket Number	02307Z-137500US
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ENCLOSURES *(Check all that apply)*

- [ ] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
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Request for Reconsideration (4 pgs.); Return Postcard

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SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

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Date	SEPT 17, 2004

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By: [signature]

PATENT
Attorney Docket No.: 02307Z-137500US
Client Ref. No.: 2003-465-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Guodong ZHAN, Joshua D. KUNTZ and Amiya K. MUKHERJEE Application No.: 10/606,941 Filed: June 26, 2003 For: ANISOTROPIC THERMAL APPLICATIONS OF COMPOSITES OF CERAMICS AND CARBON NANOTUBES Customer No.: 20350	Confirmation No. 4434 Examiner: Duong, Tho V. Technology Center/Art Unit: 3743 **REQUEST FOR RECONSIDERATION**

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This paper is Applicants' response to the Office Action mailed September 9, 2004, in the above-referenced patent application. In view of the explanations herein, reconsideration of the application is respectfully requested.

Affirmation of Election

Applicants hereby affirm the election of Group I, claims 1-16. This election is made with traverse.

Drawings

The objection to the drawings is respectfully traversed. FIGS. **1** and **2** appearing at the end of the specification are not drawings of the invention but merely presentations of test data from the tests reported in the Examples. FIG. **1** is a bar graph presenting the thermal diffusivity data in graphical form and FIG. **2** is a transmission electron microscope image showing that the carbon nanotubes are uniformly dispersed throughout the ceramic matrix. Since these are data presentations rather than drawings of the invention, the requirement that these figures show the features specified in the claims is misplaced. Withdrawal of this objection is requested.

Claim Rejections - 35 USC § 112

The rejection of claims 1-16 for indefiniteness is respectfully traversed as well. Exothermic devices, heat sinks, and heat conduction between them occur in various applications, whether the applications be devices, constructions, locations, or systems, where an exothermic device is used and heat is transferred from it to a heat sink. Anyone reasonably familiar with heat transfer will understand the meaning of the expression "In an application requiring ..." and what the expression encompasses. The "improvement," as stated explicitly in the claim, is the interposition of the heat spreading layer with the specified limitations, and is an improvement to any application that requires heat conduction between an exothermic device and a heat sink surface. There is no indefiniteness in either of these expressions, and reconsideration of the rejection under 35 USC § 112 is respectfully requested.

Claim Rejections - 35 USC § 103

The rejection of claims 1-16 as unpatentable over the combination of Chang et al. and Eckblad et al. is likewise respectfully traversed. Neither of these references discloses nor suggests the present invention, nor do the combined disclosures of these references.

The primary reference, Chang et al., does not disclose heat transfer properties of carbon-nanotube-filled ceramic matrices at all, much less any method of controlling or modifying those properties or of making the matrices anisotropic. Chang et al. only discuss applications requiring hardness, strength, and fracture toughness, citing such applications as wear surfaces, bearing surfaces, cutting tools, and load-bearing articles such as prosthetic devices -- see column 5, lines 7-22. None of these have exothermic components that involve heat transfer to a heat sink.

The secondary reference, Eckblad et al., partially fills the disclosure gap in Chang et al., but still lacks critical distinguishing features. Eckblad et al. disclose the use of carbon nanotube/ceramic composites as heat transfer media with carbon nanotubes aligned in a specific direction to enhance the heat transfer, but the nanotube alignment in Eckblad et al. is <u>in the direction of heat transfer</u>. This is the <u>opposite</u> of what Applicants in the present application are claiming. As expressed in claim 1 of the application, the composite in accordance with this invention is uniaxially compressed <u>in a direction transverse</u> to the heat sink surface, and as explained in the specification (paragraph 0005 on page 2), this causes the carbon nanotubes to become oriented in the direction <u>parallel</u> to the heat sink surface, i.e., <u>transverse</u> to the direction of heat transfer. Eckblad et al. seek to improve heat transfer by constructing the heat transfer medium with heat transfer conduits aligned in the direction of transfer, whereas the heat transfer conduits in Applicant's medium are oriented transverse to the direction of transfer to scatter the heat flow laterally before it reaches the heat sink.

It is also important to understand that the carbon nanotubes in Applicants' heat transfer medium are not <u>aligned</u> in any particular direction but are instead merely planar or flattened out as a result of the uniaxial compression. Thus, the nanotubes are variously oriented in <u>random</u> directions transverse to the direction of heat transfer. Accordingly, the physical arrangement (on the nano-scale) in Applicants' invention is entirely distinct from that of the Eckblad et al. disclosure (they are randomly oriented rather than "aligned" and they are transverse to the direction of heat transfer rather than parallel), and not suggested by the disclosure. These distinctions are the result of the <u>uniaxial compression</u> that is recited in

Applicants' claims, and cannot be achieved by the injection molding which is the method disclosed by Eckblad et al.

The effect of the uniaxial compression of Applicants' invention, and how it differs from the effect described by Eckblad et al. is shown in Applicants' experimental data. The Examiner's attention is directed to the "Examples" in the instant specification, particularly at page 10, Table I, and FIG. 1, where the last two sets of bars demonstrate the difference in thermal diffusivity (i.e., thermal conductivity) between the two orthogonal directions. The diffusivity is much less in the direction transverse to the flat surfaces of the specimen disk than in the "in-plane" direction, and thus the heat is preferentially spread laterally rather than being encouraged to flow from the exothermic heat source toward the heat sink.

CONCLUSION

In view of the foregoing, Applicants believe all claims pending in this Application are in condition for allowance, and reconsideration of the Application is respectfully requested. Should any matters remain that can be resolved by a conference with Applicants' attorney, the Examiner is encourage to telephone the undersigned at 415-576-0200.

Respectfully submitted,

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